U. S. FOREST SERVICE

RESEARCH NOTE LS-3

KE STATES FOREST EXPERIMENT STATION • U. S. DEPARTMENT OF AGRICULTURE

Device for Automatically Starting a Recording Rain Gage When Rainfall Begins[1]

Throughout the United States, many recording rain gages are used for measuring precipitation. Most of these gages are equipped with 8-day clocks which must be wound at weekly intervals, regardless of whether or not a storm has occurred. During the year there may be a number of weekly periods with no precipitation.

The device described in this paper causes a recording rain gage to operate only when precipitation begins. The clock must be rewound and the chart changed only after a period of precipitation. Thus, many routine weekly visits to the gage are eliminated.

The automatic starter holds a fully wound clock in a stopped position. It releases the pressure when triggered by precipitation. The same basic principle has proved satisfactory when employed on FW-1 water level recorders.[2] Only those time scales for use on the "daily" clock shaft can be applied. Tests have shown that back pressure on gears placed on the "weekly" shaft will not stop the clock.

Less than 0.01 inch of water is necessary to start the recording mechanism. The initial precipitation goes through the funnel opening into a small reservoir. Weight of the water in the reservoir is sufficient to close a switch. Current is supplied to a solenoid and the plunger retracts, triggering a spring-loaded clock retainer, and releasing a second switch actuator. The clock starts ticking and the power circuit is broken.

Figure 1 shows the position and mounting of the hinged-leaf actuator switch. An extension of the leaf actuator consists of a 5-inch piece of 14-gauge copper wire soldered to the switch leaf. The leaf with extension must be shaped so that a small reservoir (1-inch section from the end of a plastic toothbrush case) placed on the free end will be directly under the funnel. The actuator leaf must not touch the bucket or funnel when the gage is "set." The switch is mounted in a spring clip holder and can be removed from the holder when removing or replacing the bucket. Wires should be long enough to permit this.

The solenoid and switch arrangement can be seen in figures 2 and 3. A 6-volt D.C. continuous-duty solenoid is used. To prevent possible damage to the solenoid through overheating and to conserve battery power, a microswitch is mounted on an L-shaped bracket with the solenoid in such a way that the energized solenoid, upon retraction, will break the circuit. When "set," a small threaded pin mounted in the plunger of the solenoid holds the microswitch leaf in the depressed position to keep the circuit closed at this point (fig. 3). Upon closing of upper switch, current is supplied to the solenoid; the plunger retracts, triggers the clock retainer, and releases the switch to break the circuit (fig. 2).

The purpose of the clock retainer assembly is to apply back pressure on the clock. The retainer is spring-loaded in the "set" position and requires very little force to trigger it. Tests using the solenoid plunger as a retainer did not prove to be satisfactory; back

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[1] *Reported by the Station's field headquarters in La Crosse, Wis., where research is conducted in cooperation with the Wisconsin Conservation Department.*

[2] *Curtis, Willie R. An automatic trigger device for use on FW-1 water level recorders. Jour. Forestry 58: 819-821, illus. 1960.*

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FIGURE 1. — Hinged-leaf actuator switch. The switch can be purchased with a 6-inch leaf actuator. A 5-inch extension is necessary. Note bends in actuator. Approximate side-to-side scale in photograph is: ½″ = 3 inches.

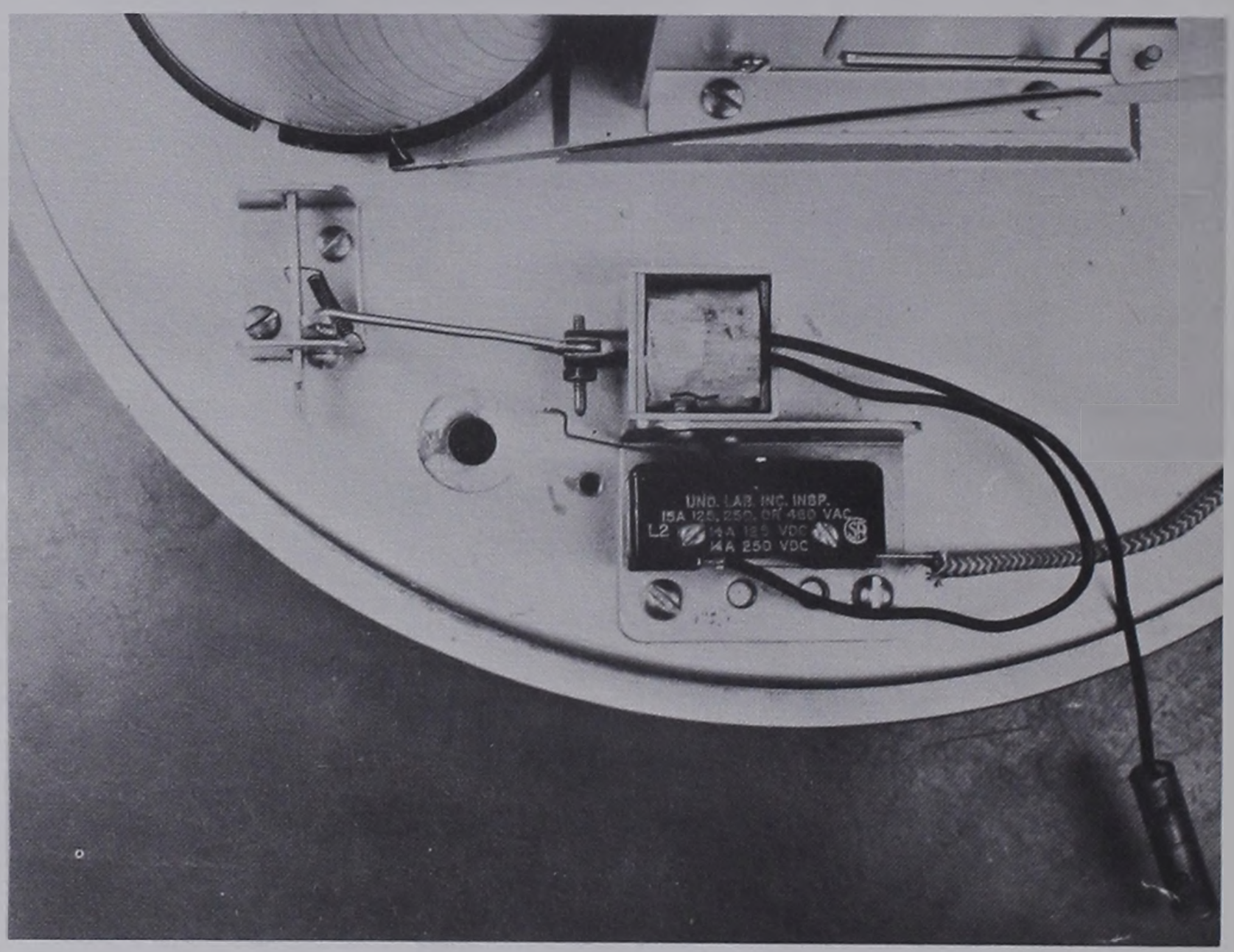

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FIGURE 2. — Solenoid switch assembly and the clock retainer in "triggered" position. Note notch in chart cylinder rim and threaded pin in solenoid plunger. This pin is used to activate the switch which breaks the power circuit when the device is triggered.

pressure on the clock was greater than the force exerted by the energized solenoid.

A 6-volt lantern battery is used for the power supply. There is plenty of room for the battery behind the recorder mechanism.

The switches used are so constructed that they can be wired in either normally open or normally closed circuits. It is important that both switches be wired to the normally open lugs.

The device is independent of the recording mechanism and can be "reset" without emptying the bucket. Loss of weight through evaporation from the gage does not affect the release mechanism. For recording precipitation as snowfall the bucket may be "charged" with an antifreeze solution. The reservoir on the upper switch is replaced by a piece of thin metal plate. When enough snow accumulates on the plate, the switch will be closed.

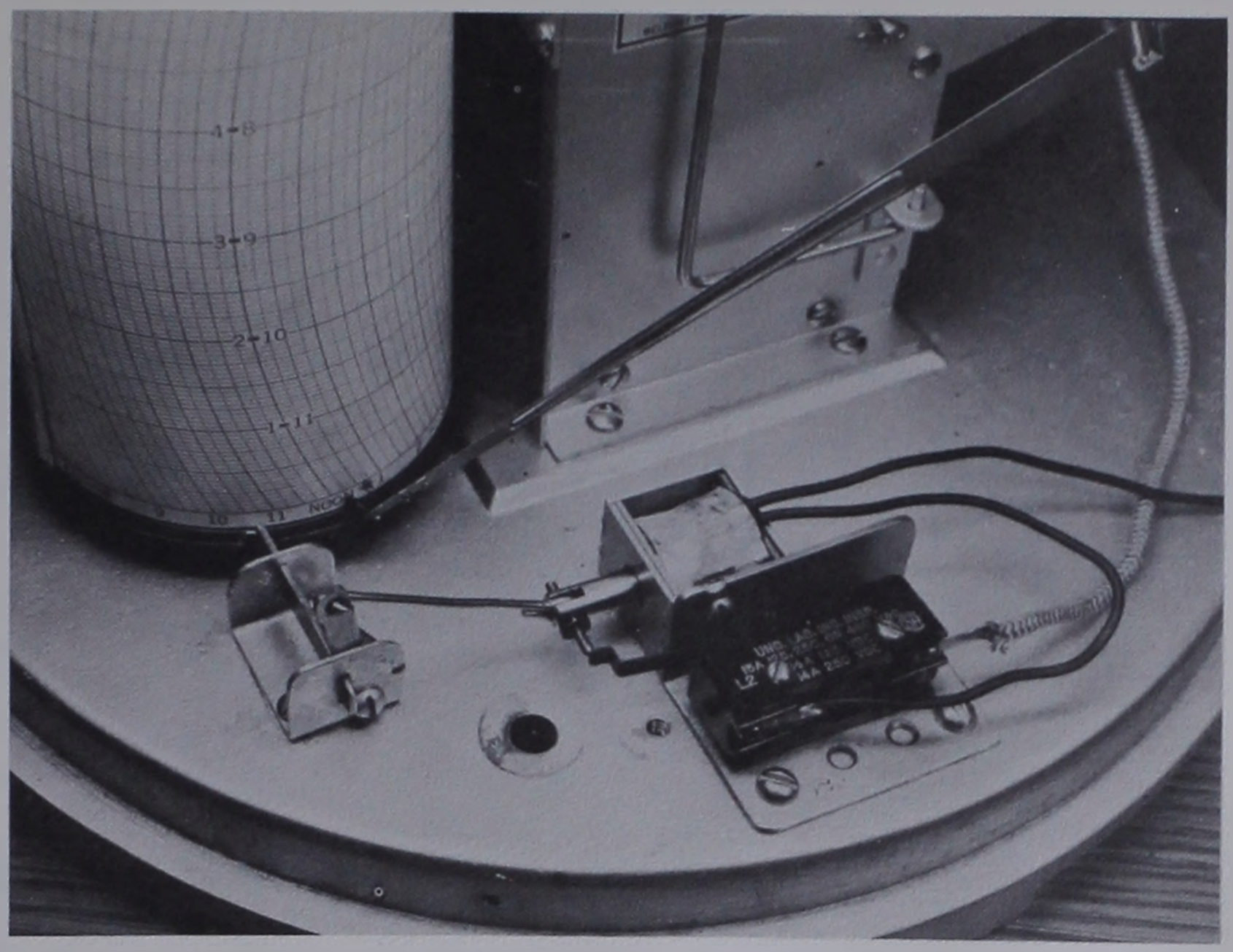

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FIGURE 3. — Device in "set" position. Spring-loaded clock retainer lever is held in notch by trigger. This trigger is attached to the solenoid plunger with 14-gauge copper wire. Pin in plunger holds switch leaf depressed, keeping the circuit closed until triggering takes place.

The device described and illustrated here was designed and constructed specifically for the model 775C gage (Belfort Instruments Corporation), but with slight modification it can be used on any float- or weighing-type of recording precipitation gage.

In computing records from the automatically started gages, it is necessary to figure time and date of storm from the end rather than from the beginning of the chart. This is only a slight inconvenience. The ink supply in the regular bucket-type pens is sufficient for periods of 2 months or longer when no precipitation occurs. Since the pen must be placed against the chart when the gage is "set," there is a continuous movement of ink from the pen to the chart. This often causes a blot on the chart, but it is not necessarily a disadvantage.

The device may be made sensitive to lesser amounts of initial rainfall by adding a few lead sinkers to the reservoir to overcome a portion of the resistance.

The mounting brackets used were fabricated from pieces of rustproof metals. The solenoid was purchased from Allied Electronics in Chicago but may also be available from other sources. Most electronics supply stores carry a full line of microswitches.[3] The parts numbers used were:

Solenoid	76PO95	6V D.C.
Top switch	BZ-2RW863	Microswitch
Bottom switch	BZ-2RL	Microswitch

However, a roller-leaf actuator on the bottom switch would eliminate the need for bending the leaf as was done here. The roller-leaf actuator switch number is BZ-2RL2.

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[3] *Manufactured by Micro Switch Division of Minneapolis-Honeywell Regulator Company, Freeport, Illinois.*

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